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भाग 31 एंक्लोज़र “टी” द्वारा उपस्कर धूल प्रज्वलन सुरक्षा

Indian Standard

EXPLOSIVE ATMOSPHERES

PART 31 EQUIPMENT DUST IGNITION PROTECTION BY ENCLOSURE “t”

ICS 29.260.20

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

November 2012 **Price Group 4**

Electrical Apparatus for Explosive Atmospheres Sectional Committee, ETD 22

NATIONAL FOREWORD

This Indian Standard (Part 31) which is identical with IEC 60079-31 : 2008 'Explosive atmospheres — Part 31: Equipment dust ignition protection by enclosure "t" ' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Electrical Apparatus for Explosive Atmospheres Sectional Committee and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, references appear to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60034-1 Rotating electrical machines — Part 1: Rating and performance	IS/IEC 60034-1 : 2004 Rotating electrical machines: Part 1 Rating and performance	Identical to IEC 60034-1 : 2004
IEC 60079-0 Explosive atmospheres — Part 0: Equipment — General requirements	IS/IEC 60079-0 : 2007 Explosive atmospheres: Part 0 Equipment — General requirements (*first revision*)	Identical to IEC 60079-0 : 2007
IEC 60079-7 Explosive atmospheres — Part 7: Equipment protection by increased safety "e"	IS/IEC 60079-7 : 2006 Explosive atmospheres: Part 7 Equipment protection by increased safety "e"	Identical to IEC 60079-7 : 2006
IEC 60127-1 series, Miniature fuses	IS/IEC 60127-1 (All parts) Miniature fuses	Identical for the editions adopted
IEC 60691 Thermal-links — Requirements and application guide	IS/IEC 60691 : 1993 Thermal-links — Requirements and application guide	Identical to IEC 60691 : 1993
ISO 965-1 ISO general-purpose metric screw threads — Tolerances — Part 1 : Principles and basic data	IS 14962 (Part 1) : 2001 ISO general-purpose metric screw threads — Tolerances: Part 1 Principles and basic data	Identical to ISO 965-1 : 1998
ISO 965-3 ISO general-purpose metric screw threads — Tolerances — Part 3: Deviations for constructional threads	IS 14962 (Part 3) : 2001 ISO general-purpose metric screw threads — Tolerances: Part 3 Deviations for constructional screw threads	Identical to ISO 965-3 : 1998

BIS Certification Marking is applicable to product covered under this Indian Standard, the detail of which is given in National Annex A.

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard, and as such the page numbers given here are not the same as in the IEC Publication.

(*Continued on third cover*)

Indian Standard

EXPLOSIVE ATMOSPHERES

PART 31 EQUIPMENT DUST IGNITION PROTECTION BY ENCLOSURE “t”

1 Scope

This part of IEC 60079 is applicable to electrical equipment protected by enclosure and surface temperature limitation for use in explosive dust atmospheres. It specifies requirements for design, construction and testing of electrical equipment.

This standard supplements and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirement of this standard shall take precedence.

This standard does not apply to dusts of explosives, which do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard does not apply to electrical equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

NOTE 1 The application of electrical equipment in atmospheres, which may contain combustible dust as well as explosive gas, whether simultaneously or separately, may require additional protective measures.

NOTE 2 Where the equipment has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional methods of protection may be necessary. The method used should not adversely affect the integrity of the enclosure.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-7, *Explosive atmospheres – Part 7: Equipment protection by increased safety “e”*

IEC 60127 series, *Miniature fuses*

IEC 60691, *Thermal-links – Requirements and application guide*

ISO 965-1, *ISO general-purpose metric screw threads – Tolerances – Part 1: Principles and basic data*

ISO 965-3, *ISO general-purpose metric screw threads – Tolerances – Part 3: Deviation for constructional screw threads*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0, as well as the following definitions, apply.

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426[1] [1].

3.1

dust ignition protection by enclosure "t"
type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures

3.2

joint
place where the corresponding surfaces of two parts of an enclosure, or the conjunction of enclosures, come together

3.3

gasket
a compressible element provided in a joint to provide protection against the ingress of dust

4 Level of protection

Type of protection "t" is divided into three levels of protection, "ta", "tb" and "tc". For each level of protection, an equipment protection level (EPL) has been assigned based on the risk of the equipment becoming an ignition source in a hazardous atmosphere.

4.1 General

Equipment with dust ignition protection by enclosure "t" shall be either

- level of protection ta (EPL "Da"), or
- level of protection tb (EPL "Db"), or
- level of protection tc (EPL "Dc").

The requirements of this standard shall apply to all levels of protection "t" unless otherwise stated.

4.2 Additional requirements for level of protection "ta"

For level of protection "ta", the requirements of IEC 60079-31 shall apply, in addition to the following. The power supply to level of protection "ta" equipment shall be rated for a prospective short circuit current of not more than 10 kA.

4.2.1 Thermal protection

4.2.1.1 General

Where the equipment is capable of exceeding the maximum surface temperature as a result of an abnormal operating condition, a protective device shall be provided either external to the equipment or directly integrated into the equipment. The protective device shall be capable of interrupting the maximum current of the circuit in which it is installed. Where the equipment contains a cell or battery and a control device is provided to prevent overheating of the cell or battery, the control device can also be considered as a protective device, providing it also protects the complete equipment from exceeding the maximum surface temperature.

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[1] Figures in square brackets refer to the bibliography.

NOTE The response time of the thermal protective devices should be taken into account and demonstrated by the manufacturer that they are adequate for the necessary overtemperature protection.

4.2.1.2 Protective devices

The equipment shall be protected by an integral thermal protective device. This thermal protective device shall not be a self-resettable type and must be duplicated unless it complies with IEC 60127 or IEC 60691, then only one device is necessary. Alternatively, if it can be demonstrated that an overcurrent protective device can be used to provide thermal protection, such a device may be used to combine temperature protection and overcurrent protection. The overcurrent protective device shall comply with IEC 60127 and shall be rated at not more than 170 % of the maximum rated current. When an overcurrent protective device is not also used as a thermal protective device, it is permissible for the overcurrent protective device to be located outside of the enclosure of the electrical equipment. In this case, the marking shall include the symbol "X" in accordance with IEC 60079-0 and the Specific Conditions of Use shall detail the required overcurrent protective device.

4.2.1.3 Temperature limitation

The temperature of internal devices and components shall not exceed the temperature rating of the equipment under the test conditions of the thermal test in 6.1.2.

5 Construction

5.1 Joints

5.1.1 General

All joints in the structure of the enclosure, whether permanently closed or designed to be opened from time to time, shall fit closely together within the tolerances specified in the documentation. They shall be effectively sealed against the ingress of dust and shall comply with the following particular requirements and be subjected to the test of 6.1.1:

NOTE The use of grease alone to maintain the integrity of the seal is not considered to satisfy this requirement.

- The number of engaged threads for all threaded joints, employing parallel threads without an additional seal or gasket shall be not less than five threads, with a minimum tolerance of medium or fine according to ISO 965-1 and ISO 965-3.
- Hinges shall not be used as a means of maintaining a seal unless:
  - correct compression of the gasket is achieved without causing undue movement, stress or distortion to the gasket; and
  - they are manufactured from materials that would not give rise to sufficient wear that may affect the correct function of the sealing means .

Where necessary, a means shall be provided for mating parts to facilitate correct alignment.

5.1.2 Gaskets and seals

Gaskets under compression in joints may be used to ensure the effectiveness of the enclosure sealing.

All gaskets and seals shall be of one-piece continuous construction, i.e. with an uninterrupted periphery.

NOTE 1 One-piece construction would also include gaskets and seals that have been permanently joined to form an uninterrupted periphery while maintaining the mechanical properties of the gasket or seal material.

NOTE 2 Unless all gaskets are secured to one face of the mating surface, either by adhesive or mechanically secured, the design of the enclosure should be such that determination of the correct location of the gaskets can be made.

Except for a slight amount of lubricant necessary for assembly, joints using gaskets shall not be supplemented by the application of a sealant material except for an adhesive material on one side of the mating surfaces.

A flexible seal, e.g. a bellows, shall be such that it is not over-stressed at any point and shall be protected from external mechanical damage and secured at each end by mechanical means.

5.1.3 Cemented joints

Cemented joints shall not:

- be used on mating parts, which need to be removed to gain access to field wiring connections or in-service adjusting facilities; and
- have a width less than 3 mm.

5.1.4 Operating rods, spindles and shafts

Openings in enclosures for rods, spindles or shafts shall have means to inhibit the ingress of dust, other than only grease or compound, both when the spindles, rods or shafts are in motion and when they are at rest.

5.1.5 Windows

5.1.5.1 Windows employing a cemented joint

A window design employing a cemented joint shall be such that it is cemented either directly into the wall of the enclosure so as to form with the latter an inseparable assembly, or into a frame such that the assembly can be replaced as a unit.

5.1.5.2 Windows employing a gasket joint

A window design employing a gasket for dust exclusion shall be such that it is mounted directly in the wall or cover of the enclosure. No separate detachable frame is required.

5.2 Cable glands and threaded entries

5.2.1 Cable glands

Cable glands, whether integral or separate, shall meet the requirements of IEC 60079-0, and the joint requirements of 5.1. In addition to these requirements, cable glands for “ta” shall be subjected to the tests of 6.1.1.

Where cable glands are integral with the enclosure or specific to the enclosure they shall be tested as part of the enclosure.

Where cable glands are separate:

- threaded Ex cable glands can be evaluated as equipment
- other cable glands can be evaluated only as an Ex component.

5.2.2 Threaded entries

Threaded entries with tapered threads are considered to meet the requirements for “ta”, “tb” and “tc” equipment. Threaded entries with parallel threads shall be provided with not less than five threads, with a minimum tolerance of medium or fine according to ISO 965-1 and ISO 965-3.

6 Verification and tests

6.1 Type tests

6.1.1 Type tests for dust exclusion by enclosures

Samples of the equipment shall be subjected to the thermal endurance to heat, thermal endurance to cold and mechanical tests of IEC 60079-0.

The samples shall then each be subjected to the pressure test of 6.1.3, Finally, the samples shall each satisfy the requirements shown in Table 1.

Table 1 – Ingress protection[a]

Level of protection	IIIC	IIIB	IIIA
"ta"	IP6X	IP6X	IP6X
"tb"	IP6X	IP6X	IP5X
"tc"	IP6X	IP5X	IP5X

[a] Ingress protection is to be determined in accordance with degree of protection (IP) of enclosures as specified in IEC 60079-0 for level of protection "tb" and "tc". For level of protection "ta" the level of depression shall be increased to at least 4 KPa for a period of least 8 h. Any grease in the joints should be removed before the IP test is performed.

6.1.2 Thermal tests

This test shall be carried out as described in IEC 60079-0 with the test voltages and overload or fault conditions applied as specified in Table 2. For level or protection "ta" equipment, the requirements of 4.2 apply, and the maximum surface temperature shall be determined with the equipment mounted in accordance with the manufacturer's instructions, and surrounded on all available surfaces by dust with a layer thickness of at least 500 mm.

Table 2 – Conditions for the determination of maximum surface temperature

Type of electrical equipment	Test voltage	Overload or fault conditions
Luminaires (without ballast)	U_n + 10 %	None
Electromagnetic ballast	U_n + 10 %	U_n + 10 % Rectifier effect simulated by diode[a]
Electronic ballast	U_n ± 10 %	[b]
Motors	U_n ± 10 %[c]	None
Resistors	U_n + 10 %	None
Electromagnets	U_n + 10 %	U_n and worst-case air-gap
Other equipment	U_n ± 10 %	As specified by the applicable standard for industrial equipment

NOTE U_n is the rated voltage of the equipment.

[a] The rectifier effect is only to be simulated in the case of electromagnetic ballasts for tubular fluorescent lamps.

[b] Additional tests to determine the luminaire temperature during "lamp end-of-life" are under consideration. Some additional guidance can be found in IEC 60079-7.

[c] Alternatively, determination of the maximum surface temperature may be conducted within Zone A (as per IEC 60034-1). In this case, the equipment shall be marked with the symbol "X" in accordance with IEC 60079-0 and the specific condition of use shall include the information that the surface temperature determination was based on operation within Zone A (IEC 60034-1), typically ± 5 % of rated voltage

6.1.3 Pressure test

A positive internal pressure of at least;

- 4 kPa for level of protection “ta” equipment, or
- 2 kPa for level of protection “tb” and “tc” equipment

shall be applied to the equipment for at least 60 s. During this test, any breathing or draining device shall be removed and the entry plugged. There shall be no evidence of damage to the enclosure due to the pressure applied. The sample shall be subjected to the IP test in the condition it is in after the completion of this test.

This test is not required for cable glands evaluated as Ex apparatus.

6.2 Routine tests

There are no additional routine tests required for levels of protection “ta”, “tb”, or “tc”.

7 Marking

These requirements supplement the requirements of IEC 60079-0, which are applicable to types of protection "ta", “tb” and “tc”. The symbol for the type of protection used shall be “ta”, “tb”, or “tc”, as applicable.

The maximum allowable prospective short circuit current of the source of supply shall be marked on the equipment for type of protection “ta” equipment.

Bibliography

IEC 60050-426, *International Electrotechnical Vocabulary (IEV) – Part 426: Equipment for explosive atmospheres*

NATIONAL ANNEX A

(*National Foreword*)

A-1 BIS CERTIFICATION MARKING

The product may also be marked with the Standard Mark.

A-1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

(*Continued from second cover*)

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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